Small Business Innovation Research/Small Business Tech Transfer

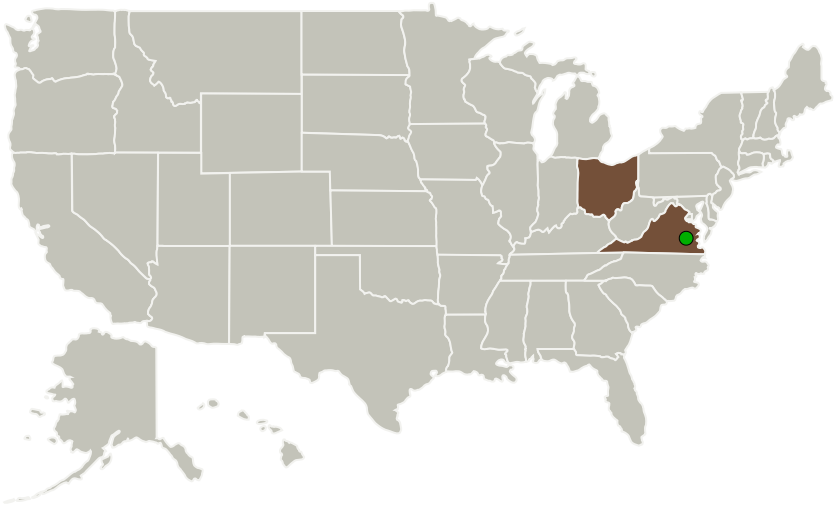
Fast Responding Pressure-Sensitive Paint for Large-Scale Wind Tunnel Testing, Phase II

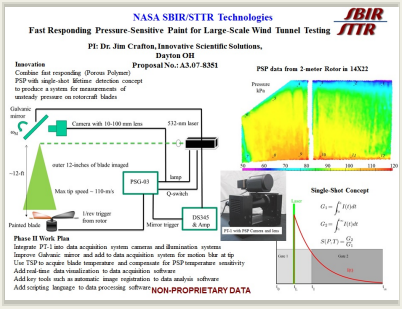
Completed Technology Project (2014 - 2017)

Project Introduction

The proposed work focuses on implementing fast-response pressure-sensitive paint for measurements of unsteady pressure in rotorcraft applications. Significant rotorcraft problems such as dynamic stall, rotor blade loads in forward flight, and blade-vortex interaction all have significant unsteady pressure oscillations that must be resolved in order to understand the underlying physics. Installation of pressure transducers is difficult and expensive on rotorcraft models, and the resulting data has limited spatial resolution. Application of a fast-responding pressure-sensitive paint should provide unsteady surface pressure distributed over the blade surface. Fast PSP measurements have been demonstrated at NASA Langley on a 2-meter rotor model in hover and in forward flight by the ISSI/OSU team using two single camera systems. More recently, measurements were conducted in forward flight using multiple cameras and lasers at two azimuthal positions. We propose expanding this system for production testing. During Phase I, a lens controller + pan/tilt stages with Ethernet control and presets was developed. This device will be used to control the field of view of the system remotely. Mitigation of motion blur at the tip was demonstrated using a galvanic mirror. A temperature measurement capability using TSP was added to the system to allow temperature corrections to be applied to the PSP data. Fast efficient data processing software that included automatic image registration and scripting of repetitive operations was investigated to speed up data processing. These new tools and software will be integrated into the data acquisition package and data processing package to improve accuracy and productivity during testing.

Primary U.S. Work Locations and Key Partners





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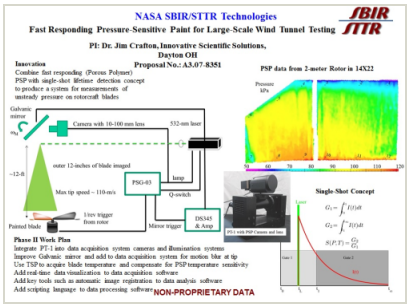
Organizations Performing Work	Role	Type	Location
Innovative Scientific Solutions, Inc.	Lead Organization	Industry	Dayton, Ohio
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Ohio	Virginia

Images



Briefing Chart Image
Fast Responding Pressure-Sensitive Paint for Large-Scale Wind Tunnel Testing, Phase II *(https://techport.nasa.gov/image/135713)*

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Innovative Scientific Solutions, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Jim Crafton

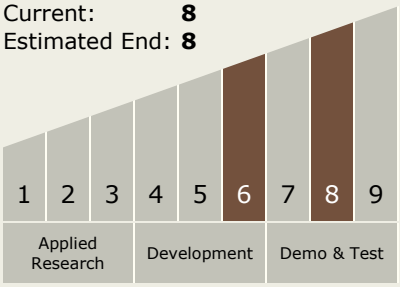
Co-Investigator:
James Crafton

Fast Responding Pressure-Sensitive Paint for Large-Scale Wind Tunnel Testing, Phase II

Completed Technology Project (2014 - 2017)

Technology Maturity (TRL)

Start: **6**
Current: **8**
Estimated End: **8**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.3 Optical Components

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System